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# APPLIED SCIENCE

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# Applied Science

INCORPORATED WITH

TRANSACTIONS OF THE UNIVERSITY OF TORONTO
ENGINEERING SOCIETY

Old Series Vol. 26 TORONTO, APR. 1914 New Series Vol. VIII. No. 12

## THE EXTENSION OF THE TORONTO WATERWORKS SYSTEM

By Professor Robert W. Angus

(*Concluded*)

### Intake Shaft

Through the centre of the intake crib, a vertical steel shell will be sunk to a depth to meet the tunnel. This shell will rise inside the crib above the lake level, and will have proper openings for the admission of water to its interior; these ports to have gates that may be closed when desired. The material will be excavated from the inside of this shaft, which will be lined with brickwork to finish 11 feet inside diameter.

### Tunnel

A tunnel will be driven between the shore and intake shaft, having an inside diameter of 9 feet with a brick or concrete lining. As it is possible that compressed air will be necessary in the driving of this tunnel, and in order to make it perfectly safe for workmen, the invert will not be over 105 feet below the lake level. The length of the tunnel will be about 6,380 feet.

### Shore Shaft

This shaft will be of similar dimensions to that at the intake, but with a diameter of 10 feet inside the brick or concrete lining; will be closed at the top, and at 13½ feet below zero lake level will have two 7 foot diameter horizontal branches, to which the suction pipes of the pumps will be directly connected. The cover on the shore shaft will be quite high enough to prevent damage from surges in the tunnel, these being very small, owing to the low tunnel velocity of only 1.71 feet per second when delivering 60 million Imperial gallons per 24 hours.

### Capacity of Tunnel and Shafts

With a draft of 100 million Imperial gallons per 24 hours the loss of head in the tunnel and shafts will be under 2.5 feet, so that the capacity will be much above 100 million gallons if it is desired to increase the demand above this amount at any time.

### Pumping Station and Filtration Plant

The general scheme of the station has been described already. There are two parts which will be described separately:—

### Low Lift Station

1. The purpose of the pumps in this station is to take water from the tunnel shaft and deliver it to the filters. They will be driven by steam and have a total capacity of 60 million Imperial gallons per 24 hours. The lift at zero lake level may be approximately 75 feet, depending upon the make of the filters used. In order to procure the best use of the tunnel, the floor of this station should be at lake level. An excavation will be made and the station built with watertight walls and basement. In order to insure safety, there will be two 48 inch delivery pipes to the filter plant, each conduit carrying away the water from two pumps.

### High Lift Station

2. This station will also contain steam driven pumps, having total capacity of 60 million Imperial gallons per day, three having a total lift of approximately 220 feet, and the fourth with a lift of about 315 feet. The precise lift is yet to be determined. The floor level of this station will be at the ground level of Victoria Park.

Filtered water will be delivered to this station through a single seven-foot pipe, the suction of each pumping unit being connected directly thereto. There will be four separate discharge pipes, each 36 inches in diameter, one from each pump, and connected to the distribution system.

### Boiler Room, Coal, Storage, Etc.

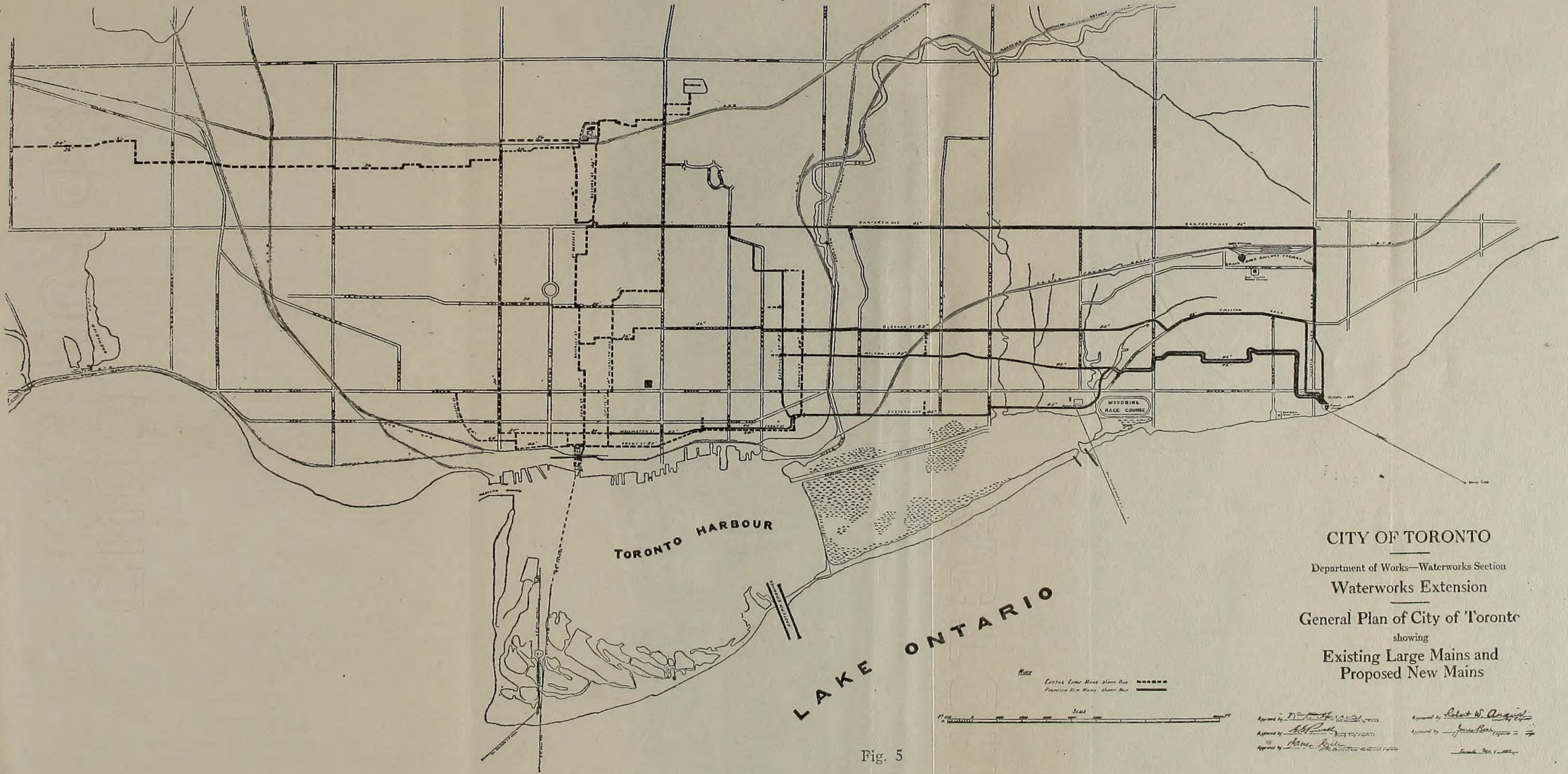
The boiler room will be located between the engine rooms. This arrangement brings the boilers close to all pumps, thus giving good steam connections, and also precludes any interference whatever between the boiler and engine foundations and the water pipes. This latter matter is of the very greatest importance. Much attention has been given to the security of the system, and the prevention of damage to the pipes from any cause. It is essential that they must always be easily accessible for examination and repairs.

The boilers will be equipped with mechanical stokers, and the boiler room will be furnished with coal and ash handling machinery, so as to reduce the cost of operating the plant, to a minimum.

Coal will be conveyed to the plant in railroad cars drawn by electric motor, along tracks laid to York Station, a distance of one and one-half miles.

The coal bunkers will have a storage capacity equivalent to one week's supply.

The matter of an additional reservoir is one requiring careful study. There is no convenient location for a reservoir in the eastern


TORONTO HARBOUR
LAKE ONTARIO
WOODBINE RACE COURSE
Note
Existing Large Mains shown thus
Proposed New Mains shown thus
Scale
Approved by
Approved by Robert W. Angus

## CITY OF TORONTO

Department of Works—Waterworks Section

## Waterworks Extension

General Plan of City of Toronto
showing
Existing Large Mains and
Proposed New Mains

Fig. 5

part of the city, and it would have to be located far beyond the city limits if placed in this direction.

An additional reservoir for the city of Toronto is by no means essential, and not at all requisite. It is desirable that there should be some water storage to provide for fluctuations in demand from time to time. This storage has already been adequately provided for in the Rose Hill Reservoir, which has ample capacity for all the present and proposed pumping equipment, and will readily suffice for the needs of Toronto for some time to come.

Since a proposition has been made to establish a second reservoir in connection with plans of the commission of 1912, it may be well to point out, that if a second reservoir were to be used on the same supply mains as the present Rose Hill Reservoir, then the new reservoir would have to be placed on exactly the same level as that at Rose Hill. As hereinbefore stated, if the new one were the higher, as proposed by the commission, the present reservoir would be flooded.

An examination of the country has shown that to secure suitable land for such a reservoir, it would be necessary to go so far out that much of its effect would be lost. Such a plan cannot be recommended.

The present Rose Hill Reservoir has a capacity of thirty-nine and a quarter million Imperial gallons, which corresponds to about twenty hours' supply at the present average daily pumpage of approximately fifty million Imperial gallons, and is quite sufficient to compensate the ordinary fluctuations of discharge, due to fires, excessive heat or cold, and other causes.

It will be interesting in this connection, to give the experience of some of the larger American cities, using lake water. Buffalo, with an average daily consumption of 117 million Imperial gallons, has a single reservoir holding 98 million gallons of twenty hours' supply. Detroit, with an average daily consumption of nearly 88 million Imperial gallons, has no reservoir. Chicago does not possess a reservoir. In Cleveland, the average daily consumption is 63 million Imperial gallons, and the city is divided up into three districts for distribution purposes, there being a reservoir for each district, the largest having a capacity of 67 million Imperial gallons. Milwaukee has a present consumption of about 79 million Imperial gallons, and is now increasing its piping capacity, but there is no intention of increasing the capacity of the reservoir, which holds only 17 million Imperial gallons, or about six hours' supply.

The foregoing examples show that Toronto has now a much larger reservoir capacity than many other of the larger cities, the size of the reservoirs being evidently largely influenced by local conditions. The experience of the cities quoted, confirms the conclusion otherwise reached, that there is no necessity at present to increase the reservoir capacity for this city.

## Pitometer Survey

For many months past, a pitometer survey has been under way, whereby the maximum, minimum and average flow into small sections of the city, was ascertained. The survey covered the entire city, and we have been enabled to compile Plan No. 4, giving this information.

The area of Toronto, excluding the Island, Torontlo Harbor, Ashbridge's marsh lands, Humber Bay, and that portion of the lake west of the Island, within the city limits, approximates 29.6 square miles, or 18,949 acres.

It will be seen from the plan that the average consumption per day over the section of the city above described, within the period covered by the compilation, averaged 46,247,000 Imperial gallons.

An examination of the plan and the figures thereon, shows that in Districts "B" and "C" comprising the area bounded on the east by the River Don, and on the north by Wellesley Street to Yonge Street, south to College Street, west on College Street to the Northern Division of the Grand Trunk Railway System, thence south-easterly along that right-of-way to Dufferin Street, thence south on Dufferin Street to the Grand Trunk Western Division, thence westerly to Humber Bay, the average daily consumption amounts to 26,335,000 Imperial gallons, or 56.9 per cent. of the total water supplied, or in other words, 56.9 per cent. of the total water supplied per day, is consumed in 3,433.19 acres, which constitutes 18.1 per cent. of the entire acreage of the city.

These figures are illuminating, and show that the maximum usage is in the business and manufacturing section of the city. They also indicate that especial distribution service must be provided in order to convey the requisite quantity of water at adequate pressure to the maximum user.

## Distribution System

From the pump-house there will be four 36-inch pipes, with Venturi meters, running a short distance from the station, after which they will be enlarged for distribution purposes and will feed four 42-inch mains, all of these pipes being cross-connected and controlled by valves in such a way as to make a perfectly flexible arrangement. These four mains will then run across Queen Street, their locations being approximately as follows:—

1. One 42-inch main will run across Queen Street, up Victoria Park Avenue to Danforth Avenue, along Danforth Avenue, over the new Bloor Street Viaduct to Bloor Street, and along Bloor Street to St. George Street. At the corner of Bedford Road this main will be cross-connected to the present 36-inch main, valves being provided so that the connection may be closed as desired. For the present this main will be placed on the service of the middle district, and hence the connection at Bedford Road will be closed, but should it be desirable to serve the low level district, this valve will be opened, and all connections with the middle district closed.

As already stated, this main will be used on the middle district, and will, therefore, be connected to the 12-inch main at Coxwell Avenue, to the 12-inch main at Broadview Avenue, and to a new main included in this project at Sherbourne Street. It will also

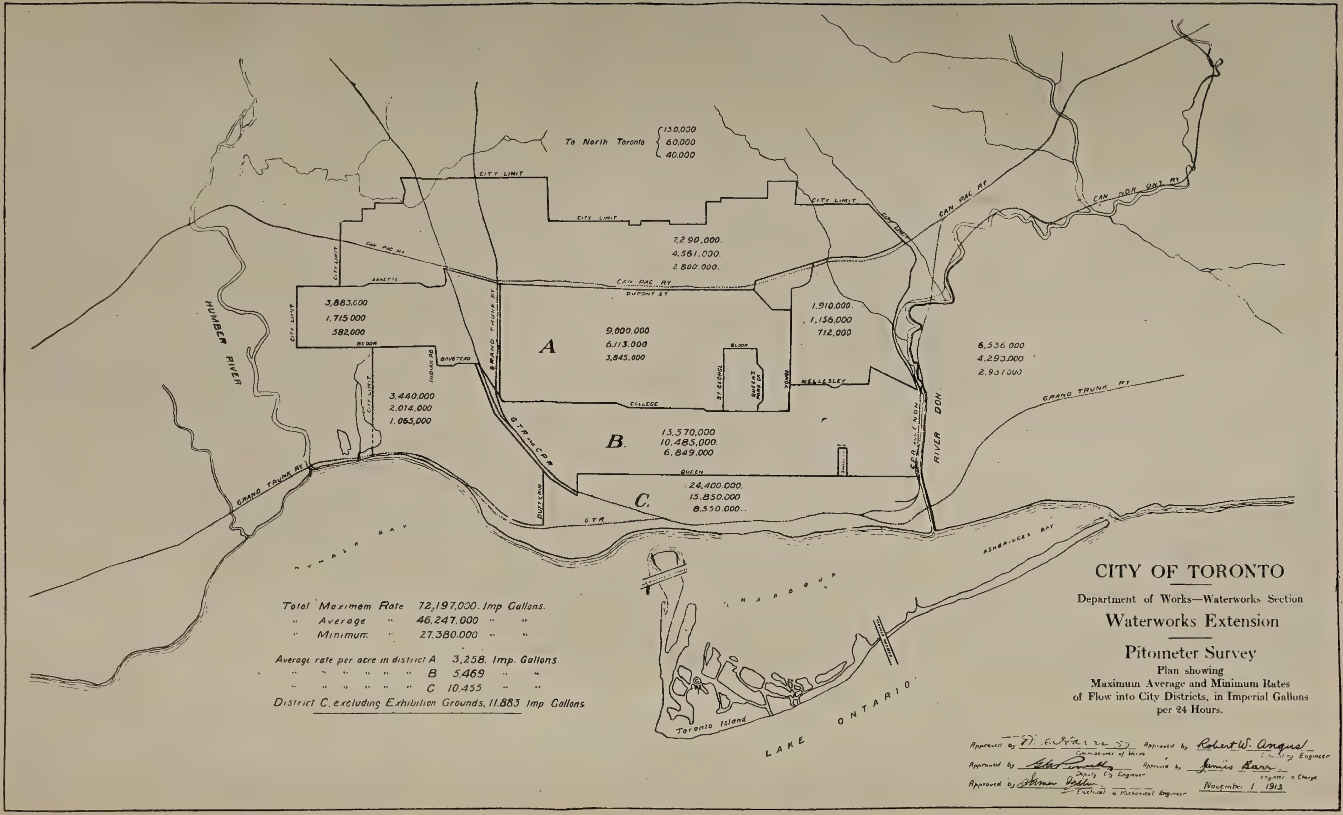

CITY OF TORONTO
Department of Works—Waterworks Section
Waterworks Extension
Pitometer Survey
Plan showing
Maximum Average and Minimum Rates
of Flow into City Districts, in Imperial Gallons
per 24 Hours.
Approved by Commissioner of Works
Approved by Robert W. Angus Consulting Engineer
Approved by Deputy City Engineer
Approved by James Barr Engineer in Charge
Approved by Electrical & Mechanical Engineer
November 1 1913
Total Maximem Rate 72,197,000. Imp Gallons.
" Average " 46,247.000 " "
" Minimum " 27.380.000 " "
Average rate per acre in district A 3,258. Imp. Gallons.
" " " " " " B 5.469 " "
" " " " " " C 10.455 " "
District C, excluding Exhibition Grounds, 11.883 Imp Gallons
To North Toronto 150,000 60,000 40,000
7.290,000. 4.561.000. 2.800.000.
3,883,000 1.715 000 582,000
9,000.000 6,113.000 3,845,000
A
1.910,000. 1.156,000 712,000
6,536 000 4.293,000 2.937000
3.440,000 2,014,000 1.065,000
B.
15.570,000 10.485,000. 6.849,000
C.
24,400.000. 15.850.000 8.550.000..
CITY LIMIT
CAN PAC RY
ANNETTE
BLOOR
DUPONT ST
GRAND TRUNK RY
INDIAN RD
BOUSTEAD
COLLEGE
ST GEORGE
QUEENS PARK CR
YONGE
WELLESLEY
QUEEN
DUFFERIN
GTR
GTR AND CPR
CPR AND C NOR
CAN NOR ONT RY
RIVER DON
HUMBER RIVER
HUMBER BAY
HARBOUR
ASHBRIDGES BAY
Toronto Island
LAKE ONTARIO

Fig. 4

be connected with the 16-inch main on St. George Street. All of these connections will have valves.

The discharge pressure on the pumps at the High Level Station supplying the middle district is 65 pounds per square inch, and hence, after making allowance for friction and difference of level, the pressure at the Victoria Park Station on the pump supplying the above 42-inch main will be approximately 137 pounds per square inch. While this pressure is higher than usual, yet the pipe rises rapidly after leaving the station, and there will be only about 2,000 feet of it subjected to a pressure of over 100 pounds.

2. The second 42-inch main will run from the Park across two lots to be purchased south of Queen Street to Kingswood Avenue, then up Kingswood Avenue to Kingston Road to Heyworth Crescent to Woodbine Avenue, across two lots to be purchased to Patricia Road and through two lots to Small Street, to Gerrard Street, and then along Gerrard to Sackville Street.

This main will connect with the 12-inch main on Beach Avenue, the 12-inch main on Leslie Street, the 12-inch main on Carlaw Avenue, the 12-inch main on Broadview, the 24-inch main on Sumach Street, and the proposed 42-inch main on Sackville Street.

3. The third 42 inch main will run from the park across the lots mentioned south to Queen Street to Scarborough Road, north to Pine Avenue, to Balsam, to Pine Crescent, to extension of Williamson Road to Lee Avenue. It will then run north on Lee Avenue to the proposed extension of Norway Place, along Norway Place to Woodbine Avenue to Dixon Street, across Kingston Road to Edgewood, to Hemlock, to Maughan Crescent, to Ashbridge, to Applegrove, to Wilton Avenue extension, and along Wilton Avenue to Sackville Street.

This main will connect with the 12 inch main on Coxwell Avenue, the 12 inch main on Leslie Street, the 12 inch main on Carlaw Avenue, the 12 inch main on Broadview Avenue, the 24 inch main on Sumach Street, and the proposed 42 inch main on Sackville Street.

4. The fourth 42 inch main will run along the same streets as the third, to Maughan Crescent. It will then run south on the extension of Orchard Park Road to Orchard Park Road, across Queen Street, through a corner of the Ontario Jockey Club grounds to Eastern Avenue, and along this street to Cherry Street, thence to Front Street, to Wellington Street, to Simcoe Street.

This main will connect with the 12 inch main on Kingston Road, the 12 inch main on Leslie Street, the 12 inch main on Carlaw Avenue, the 12 inch main on Broadview Avenue, the 24 inch main on Sumach Street, the proposed 42 inch main at Sackville Street, the 12 inch main at Sherbourne Street, the 12 inch main at Jarvis Street, the 12 inch main on Yonge Street, the 24 inch and 36 inch mains on Simcoe Street.

5. In order to make this system most effective, a new 42 inch main will be laid up Sackville Street from the corner of Eastern Avenue and Cherry Street to Wellesley Street, thence along Welles-

ley Street to Parliament Street or Rose Avenue, to Howard Street, to Sherbourne Street, to Bloor Street.

This main will connect with the proposed new 42 inch mains at Cherry Street, Wilton Avenue, Gerrard Street and Bloor Street, but at the latter point there will be a closed valve normally, as the Bloor Street main will work on the middle district. It will also connect with the present system at the 12 inch main on Queen Street, the 12 inch main on Wilton Avenue, the 36 inch main on Gerrard Street, the 12 inch main on Carlton Street, and the 12 inch main on Wellesley Street.

A study of Plan No. 5 showing these mains, and their connections to the present system, will make it perfectly obvious, that this distribution plan will give ample accommodation for the water from this new station to reach all points of the city, and will enable the new station to work in perfect harmony with the present plant.

The estimated cost of the project recommended is as follows:

**Estimated Cost of Project as Recommended**

| | |
|---|---|
| Lake crib—complete and placed | $ 400,000.00 |
| Lake shaft, tunnel, and shore shaft | 800,000.00 |
| Site and buildings | 500,000.00 |
| Pumping equipment | 380,000.00 |
| Boilers and stokers | 80,000.00 |
| Coal and ash handling machinery | 30,000.00 |
| Tracks and overhead equipment from York to Pumping Station | 35,000.00 |
| Motor and equipment for handling cars | 5,000.00 |
| Electric lighting unit at station | 2,000.00 |
| Twenty-six miles of distribution mains | 2,040,000.00 |
| Specials and valves | 60,000.00 |
| Filtration Plant | 600,000.00 |
| Levelling, grading, etc | 5,000.00 |
| | $4,937,000.00 |
| Add 10% for engineering and contingencies | 493,700.00 |
| | $5,430,700.00 |
| Six miles of distribution main—High Level pumping Station to West Toronto, for part of which contracts have been awarded | $ 353,000.00 |
| Additions to High Level Pumping Station, and provision of steam reserve sufficient for ultimate output of this station, for part of which contracts have been awarded | 250,000.00 |
| Total | $6,033,700.00 |

RECAPITULATION

| | |
|---|---|
| Expenditure authorized by ratepayers | $6,677,000.00 |
| Estimated cost of project as proposed | 6,033,700.00 |
| Balance to meet debenture discount and financing | $ 643,300.00 |

The Park Commissioner was favorable to the purchase of the Victoria Park area for park purposes. Mr. Harris has submitted this proposition to him, and he expresses himself as being in accord with it, inasmuch as it will not materially affect a project which he has in mind, for the extension of lake front park areas in that district.

This project in detail was laid before Dr. C. J. Hastings, medical officer of health for the city of Toronto, who sent the following letter, viz.:

Department of Public Health,
City Municipal Buildings,
Toronto, December 23rd, 1913.

R. C. Harris, Esq., Commissioner of Works, City of Toronto:

My Dear Commissioner Harris,—Replying to your communication under date of December 19th, in which you state that you propose to instal an Intake Crib in 49 feet of water at a point one mile south-east of Victoria Park in the waters of Lake Ontario, from which a tunnel 9-feet or more in diameter will lead to the shore, this tunnel to have an ultimate capacity of about 120-million Imperial gallons every twenty-four hours, that the water will be pumped from this tunnel to mechanical filters and then to the feed mains—and in which you ask for my approval of the location of the proposed intake.

With the understanding that all the sewage of the city is to be so treated as to render the affluent therefrom non-putrescible and non-pathogenic before being turned into the lake, as required under Section 93 of the Public Health Act, and that the water obtained from the aforesaid intake is to be treated by a mechanical filter and chlorinated before being supplied to the citizens, I hereby approve of the aforesaid location of the intake, the efficient treatment of the sewage as hereinbefore described being a pre-requisite to the use of the water from this source.

Respectfully yours,
(Sg'd) Chas. J. Hastings,
Medical Officer of Health.

This is in accordance with the terms of my report. See "Sewage Purification."

Section 89 of the Public Health Act of Ontario, 1912, reads as follows:—

"(1) Whenever the council of any municipality or any municipal board or commission or any company or person contemplates the establishment of or the extension of or any change in an existing water-works system, they shall submit the plans, specifications, and an engineer's report of the water supply and the works to be undertaken, together with such other information as may be deemed necessary to the Provincial Board, and no such works shall be undertaken or proceeded with until the source of supply and the proposed works have been approved by the Board.

"(2) The Board upon the application for such approval may direct such changes to be made in the source of supply or in the plans submitted as it may deem necessary in the public interest."

Section 93, sub-section 1, of such Act, reads:—

"(1) No sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind, which, either by itself or in connection with other matter corrupts or impairs or may corrupt or impair the quality of the water of any source of public water supply for domestic use in any municipality, or which renders or may render such water injurious to health, shall be placed in or discharged into the waters, or placed or deposited upon the ice of any such source of water supply, or be placed or suffered to remain upon the bank or shore of any such source of water supply, near the place from which the supply of water for domestic use is obtained, nor within such distance thereof as may be considered unsafe by the Provincial Board, after an examination thereof by a member or officer of the Board."

You will observe that the plan submitted, has been designed in accordance with the requirements of the Act, and that, if we should never require to draw further supply from the waters of Lake Ontario, under the provision of this section, we are compelled to treat the effluent from the sewage disposal works in such a manner as may meet with the approval of the Provincial Board of Health.

As provided by the Act, Mr. Harris submitted this project to the Provincial Board of Health, and copies of letters received from Dr. John W. McCullough, Chief Officer of Health for the Province, signifying approval as is also required by the Act, are given herewith.

Ontario Provincial Board of Health,
Toronto, Dec. 23rd, 1913.

Re Proposed Water Supply of City of Toronto:

Sir,—I beg to advise you that following our conversation yesterday, the Board took up the matter of the proposed new Water Supply for the City of Toronto, according to the plans, description and report submitted by you.

Approval will be given by the Board with the understanding that before this supply is allowed to be used by the public the sewage of the city poured into the lake shall be efficiently disinfected to the satisfaction of the Board.

Yours truly,
(Sg'd) John W. McCullough,
Chief Officer of Health.

R. C. Harris, Esq.,
Commissioner of Works, Toronto.

Ontario Provincial Board of Health,
Toronto, Dec. 23rd, 1913.

Re Proposed Water Supply, Toronto:

Sir,—Regarding this matter I beg to say that formal approval will be given when copies of plans, description, report and final details are supplied to the Board.

Yours truly,
(Sgd.) John W. McCullough,
Chief Officer of Health.

R. C. Harris, Esq.,
Commissioner of Works, Toronto.

The matter is now before the City Council for consideration.

# TOWN PLANNING AND CIVIC IMPROVEMENT

## AN ADDRESS BY MR. C. H. MITCHELL, C.E., PRESIDENT OF THE TORONTO CIVIC GUILD.

It is most encouraging that the towns and cities of Ontario are awakening to the importance and advantages of Town Planning and Improvement. The larger cities of Canada and America have already become active in this respect. They have realized that if they are to escape the mistakes of older cities, and avoid the conditions which make possible these mistakes, they will require an active, constructive policy with respect to transportation, housing and sanitation.

This movement is vital in some manner or other to each community because every month sees the commencement of some new settlement or perhaps the sudden rise of a village to cityhood. The growth from village to town and from town to great industrial and commerical community has been rapid in the past. And who can foretell the future of the busy part of Ontario which lies between the lakes?

In the larger Canadian and American cities the congestion due to rapid development, heedless of provision for the future, has been recently marked by a sudden realization of the situation; and civic spirit has been aroused. In most large cities nearly everyone has been bent on money-making, and a community thus absorbed can hardly be expected to give serious thought to the welfare of future generations or to the benefits which arise from the attractiveness of the home city. Now, however, a change is taking place. This is evidenced by the fact that over fifty Canadian and American cities have adopted some course for improvement of existing conditions and systematic plans for the future. Enormous financial undertakings are being projected in order to provide wide and continuous business thoroughfares for rapid transit, convenient groupings of public buildings; parks, squares, boulevards, playgrounds and gardens; clean and attractive streets, pure water supply and efficient sewage disposal; prohibition of sign and noise nuisances; enforcement of building and fire safety laws; tenement regulation and the encouragement of housing schemes.

Toronto is becoming more and more interested in practical civic improvement and planning. While many of the civic authorities are fully aware of the importance and necessity of changes and provision in anticipation of the future, it has been found that the most effective means of obtaining real action and useful legislation by the city government has been through the medium of organizations such as the "Civic Guild," the "Board of Trade," and the various Ratepayers' Associations throughout the city. These bodies study the various civic problems without the distorting vision of the prospective candidate for municipal honors. They have brought pressure to bear from the outside, toward improvements either for the immediate present or the future, which otherwise would have been overlooked or been incapable of realization owing to local or factional opposition in various parts of the city. The Civic Guild, which has an active executive committee meeting weekly, has been especially making a study of the needs of the city and has succeeded in inaugurating and bringing about many improvements which all thinking citizens unite in approving and supporting. Out of the efforts of the Guild grew the Civic Improvement Committee, appointed by the Mayor in 1911, for specially studying and outlining a comprehensive system of civic planning. The report prepared by this committee strongly urges a permanent commission for the city "clothed with the necessary powers for carrying out a broad, sane and comprehensive scheme of civic improvement."

The general subject of civic planning embraces all of those allied subjects such as street routes and widths, depths of blocks and lots, buildings, street circulation and transportation; housing with its light and air problems, sanitation and cleanliness, railroad locations, distribution of factory areas, parks, playgrounds, boulevards and in general all matters which influence the lives of the people in the community. The ideal, therefore, of city planning, is that in which all these branches are harmonized to secure for the people of the city such conditions as will obtain a maximum of efficiency in work and of enjoyment of life; in other words, to make the city a good place to work and live in.

Until quite recently it has been a common idea that city planning has been almost exclusively identified with city beautifying. This view is not fair to the whole subject because it loses sight of the practical sides of the question, which are very many and complex. City planning should mean the acquiring of a city convenient, useful, economical and healthful, as well as a city beautiful.

Civic planning may be divided into three general divisions as affecting the city or town within its boundaries, with perhaps a fourth as affecting it from the outside. These are as follows:

I. The first division concerns the circulation and transportation problem within the city, and embraces streets, railways, waterways and all means of communication.

II. The second division concerns all other public areas and buildings not devoted primarily for circulation, and would embrace first, such institutions as municipal buildings, schools, post offices and Government buildings, hospitals, libraries, museums, churches, public halls, theatres, all of which have more or less land space surrounding them; and secondly, parks, gardens, highways, boulevards, playgrounds, amusement parks, cemeteries, etc.

III. The third division relates to all of the remaining or privately owned lands within the city, and concerns more particularly the character of their development in so far as the community can control, especially as to buildings, sanitation, fire risk, density of population, adornment as to trees, gardens, etc.

IV. A fourth division may very rightly be added to the foregoing, which concerns those areas and features of development lying outside the boundaries of a city in which the city is vitally interested, but over which it probably has no control, except through some higher authority such as the province.

It is not the purpose here to describe in detail the features of the various branches of civic improvement enumerated, but rather to draw to your attention the outstanding problems which are confronting our municipalities, and more especially those which now, or may in the near future, concern the cities and larger towns of Ontario. Following out these divisions we have:

## FIRST DIVISION

### Circulation and Transportation—Street Planning

Street planning in the full sense is the key of the whole subject, whether considered from the practical or the artistic standpoint. The principle which is the very basis for the existence of cities is the facility of communication, and a city is probably more dependent upon this facility for its prosperity than upon any other physical factor under its control. This can be fully realized when it is considered that three-quarters of a city's traffic is either to or from its general centre.

Probably the worst fault with our early planning for cities has been the adherence to the "grid-iron" layout. There was a time when this was boasted of as the ideal system and even today it is being blindly followed in some of our western cities. It may have done in the days of the Romans and during the last century in America, but this is the century of rapid transit and present-day traffic demands rapid circulation with the fewest corners and the fewest delays. Interesting examples of the avoidance of the "grid-iron" are the radial and fan-like systems which have been employed in the great European capitals, such as London, Paris, Berlin and Vienna, in America in Washington, and now in Australia, where the plan for the new Federal capital embraces several hub-like centres with radiating streets.

The obvious remedy for the "grid-iron" system, after having been once established is the introduction of through diagonals, in order to facilitate rapid transit to the four corners of the city in addition to the four sides. This is the course proposed and in some cases being followed in various cities where the "grid-iron" routes have become intolerable under modern conditions. It is the proposal of the Civic Improvement Committee for Toronto to open diagonal streets northeast and northwest from near Queen and Yonge streets; these would serve the growing population in those corners of the city and their suburbs, and would carry traffic beyond the upper Don on the one side and the upper Humber on the other.

### Street Widening

Closely allied with the actual arrangement of streets is the question of their width. In the early days in Ontario nearly all streets were laid out a uniform width of 66 feet, probably because it was convenient, being the length of a surveyor's chain. You who lived with this system know how it has worked out. Hardly ever can it be said to be too wide, because if in residential quarters the space not actually occupied in roadway can be profitably laid out with grass and trees. On the other hand, how often nowadays is it not found too narrow, even in our towns on the main business streets where traffic, moving and stationary, accumulates and consequently delays the course of business. In a report on an American city an eminent town planning expert states that "every delay in traffic adds to the expense of manufacturers, the cost borne by wholesale merchants and the prices charged consumers by retail merchants; in short, that inadequate traffic facilities add to the cost of doing business and of living."

Three factors enter into the determination of street widths on business thoroughfares: pedestrian traffic, vehicular traffic, and street car traffic. On a main thoroughfare in a large city it is an accepted principle that there should be sufficient space between the centre line and the curb for a street car line and three lines of traffic, one standing at the curb, one slow-moving and one fast-moving. If in a retail store district, four lines of pedestrian traffic are provided for in each direction on each side, a 16-foot sidewalk would be required. This brings the total width of such a street to 104 feet. If one of the three vehicular traffic lines were dispensed with on each side the width could be reduced to 86 feet, which is the absolute minimum sufficient under present conditions. So apparent and acutely has this been brought home to Toronto citizens, where the space for vehicular traffic is so narrow, that an automobile and street car cannot simultaneously pass a standing vehicle, that the civic authorities have been compelled to pass a by-law prohibiting automobiles passing a standing street car whilst loading its passengers. It has also been necessary to prevent vehicles of all kinds standing an undue length of time at the curb.

Cities which are now feeling the pinch of 66-foot business streets, and those cities ambitious to have attractive and convenient business streets in the future, are quickly and seriously considering how they may widen their busy thoroughfares by at least an additional 20 feet. How this can best be done on streets already built up is engaging the attention of town planners and civic authorities throughout the continent. Two methods have presented themselves. One the establishment of a new line called the "homologated line," to which all the new buildings as built will be moved back, and the second the establishment of such a line to which, at some future date many years distant, all buildings must be moved back. In the former case the cure is unsatisfactory, as has happened in Montreal, because new buildings built to the new line become "pocketted" between adjoining old ones, and thus, if they are stores, may temporarily lose trade. The latter method provides that after the new street line and a date, say 20 years hence, are fixed, new buildings may proceed on the understanding that at the stated date the added strip will be purchased by the city at the price obtaining at the date of enactment for, say, only two or three stories of the building which must be torn away from the front. Such an arrangement makes easy construction and automatic land purchase by the city at a reasonable price, the owner having the use of it in the meantime.

### Rapid Transit

It is not the purpose here to enlarge upon the conditions brought about in civic matters by the introduction of rapid transit, either within the city and its suburbs, or outside the city in interurban traffic. The great tendency for people to live in the suburbs and country is to be noted, however, and the effect of this daily migration more than ever intensifies the traffic congestion within the city. It is a question, too, whether it does not increase the cost of living if there are not convenient and adequate facilities through the city streets for delivery of goods and supplies.

### Railways and Waterways

In olden days, when cities were walled about, the entrance was through elaborate and artistic gates which gave to the incoming visitor his first impression of the town. Nowadays, our gates are our railway stations and our harbors. These are the entrances, and from these our visitors receive their first impressions. Too often do the railways approach our towns through dirty back streets, ill kept and unattractive, if not repellent. How many of our railway stations are situated in unattractive quarters of the town, which, with some attention from the civic authorities and public-spirited citizens, can be made to look inviting and cheerful to the incoming visitor. The railway companies are beginning to do their part by the beautifying of their own station grounds by gardens and lawns. It is the duty of the citizens to help.

The same holds true for our docks on our lake and navigable river gateways—perhaps the possibilities are not so apparent because each town has its own specific problems. The outstanding instance of this movement is the truly magnificent scheme which the Harbor Commissioners have outlined for the development of Toronto harbor, which, when completed, will, without doubt, be one of the most attractive and serviceable harbors in the world.

### Street Improvement

Among the many things which can be accomplished by civic authorities in making a city attractive is by clearing the streets of various obstructions on business streets and by preserving the trees in residential streets.

The removal of electric wires and their forests of poles can be accomplished by placing them either on alleys or side streets or by meeting the question squarely and putting them underground. This would then help to preserve the trees in fine residential streets where too often the tops and centres of fine trees are cut away by linemen. The removal of unsightly overhanging signs and bill boards can be affected if concerted action is taken by determined citizens. The encouragement of planting trees and flowers and of sodding on residential streets commends itself, as does also the placing of fountains and watering places. Artistic bridges are just as easily and as cheaply built as heavy formal structures, and make a street more attractive, particularly if finished with neat balustrades and lamps.

Street lighting, especially where the hydro-electric power system throughout the Province provides such a cheap and convenient source of electricity, lends itself to the ready adornment of streets, if the lighting scheme is carried out artistically.

One might go on to all the various street features, such as walks, curbs and pavements and make a plea for clean-cut, well-planned improvements, all of which are just as possible in the smaller cities as in the larger. And, after all this is done, no community can have any excuse for permitting its streets to become unsightly with flying papers or other rubbish, and all citizens should have sufficient civic pride to see that their streets are kept looking attractive.

## SECOND DIVISION

### Open Spaces and Parks

When we think of city parks and open spaces we must think of them as utilitarian as well as beautiful—for we must have parks and recreation spaces if we are to have happy, healthy and contented citizens. It is not necessary to dwell on the various attractions or valuable features desirable within the parks themselves, but the great question which is interesting all civic authorities nowadays is how to make the parks more accessible to the people; how to get them properly located, and whether it is possible to get them connected up one with the other by an elongated park or parkway, or by a combination of street and park termed a boulevard.

This is the day of the electric street railway and of the automobile so that the total distance to be traveled is not so much a matter as the advantage of getting quickly amongst trees and flowers as a relief from the hot and dusty city. The parkways and tree-planted boulevards are to be commended as linking up several parks or open spaces as they bring the parks, so to speak, nearer the people's doors.

For pedestrians there must be small street corner parks or rest places with trees, shrubs and flowers.

### Public Buildings and Civic Centres

All the principal public buildings, such as have already been enumerated, should be set, if possible, in fine, open spaces, not only to show them off to advantage architecturally, but in order to provide a suitable park and garden setting.

This brings us to the question of a grouping of public buildings in a convenient central location which has been called "The Civic Centre." This, after all, is nothing much more than the old "town square" or "market place" on a gigantic scale. The civic centre idea is being adopted in many cities as being not only of utilitarian convenience, but best calculated to centralize civic activities and foster civic spirit. A scheme has been proposed in Toronto by the Civic Improvement Committee for a grouping of municipal, county, provincial and federal buildings in one locality north of Queen Street and between James Street and University Avenue. A later scheme is the setting of the new proposed Toronto Post Office—to cost two millions of dollars—in a suitable square on Victoria and Adelaide streets in order to properly set off its architectural features.

### Market Places

Within the heart of many of the Ontario cities there is a space which, it appears, has been going through a period of neglect the past few years—the market. It may be because of changed transportation methods, or because of the country roads, or changed methods of marketing, but if a market is to be maintained the city authorities should make the market and its appurtenances and the streets leading to and above it attractive and convenient for carrying on trade. In these days of inquiry as to "The High Cost of Living," it appears to be of vital importance that farm produce may be marketed in the easiest and quickest manner possible.

### Playgrounds

Other open places, such as playgrounds, gardens, recreation and amusement grounds, are quite as necessary for our young and old as are schools, churches and hospitals, and the value, for instance, of supervised playgrounds and children's gardens to the rising generation, cannot be over estimated. In this respect the education of the young generation, and the old, for that matter, is of vital importance toward the preservation of trees, grass and flowers in public places.

### Preservation of Scenic Beauty

There are doubtless many other areas and spaces within our cities which, though now neglected and unattractive, might readily lend themselves to useful development. Such spaces may be peculiar to the natural situation of the city. It may be a creek or a river; it can be cleaned, tumble-down buildings removed, the sides banked up and the shores planted with trees and grass. It may be a wooded valley; it can be cleaned of its refuse heaps, the wooded slopes preserved, the underbrush and stumps removed and the whole brought cheaply into a new park. It may even be an unsightly abandoned quarry; a little money spent on earth filling, walks and gardening would make it into an attractive garden. Or, it might be a winding sylvan roadway on a hillside; it can at least be kept clear of weeds and loose stones.

A picturesque valley can, at small expense, be utilized for a parkway and its drives terminate in terraced parks or connect various garden centres of the town. In some of the Ontario towns there are rivers which, on account of their annual freshets, discourage an attractive treatment of their banks—this is all the greater reason for these towns uniting to bring about conservation methods to prevent these floods; the banks within the towns could then be trimmed up with walls and the buildings upon them reconstructed in a permanent artistic manner. If factories must be on the river bank, they can, by the utilization of electric power, avoid, or at any rate mask, the unsightly ash and refuse dumps which are so common. To carry this idea still further, how much more attractive a river could be if it had a water-front space, its outer walk forming, wherever possible, a tree-shaded promenade provided with benches and other features of recreation?

## THIRD DIVISION

### Privately-owned Lands

At first glance it might seem that in a new democratic country like ours the municipality would have but small control over privately owned lands and their buildings and occupants. In a measure this is true, but we have found that many measures must be framed by the people themselves in self-defence and the common interest.

The most important of such measures are, of course, with reference to health and sanitation, and the necessity of regulations against overcrowding of houses and factories.

### The Housing Problem

The housing question is becoming acute in large densely populated cities where industrial workers are crowded into areas and buildings in proximity to their work. While this question perhaps does not concern the younger and smaller cities in general, it has an interest in particular to those cities which have a proportionately large industrial population. In these towns the municipalities can at least encourage the making of attractive, healthy and comfortable homes by the working people. This should be encouraged in every possible way by the employers themselves—to ensure their work-people being contented and efficient. "Garden Suburbs" for working men can be readily organized and should be attractive and worth while.

### Necessary Restrictions

On residential streets much attractiveness can be added by placing restrictions to keep the houses back a definite distance from the street and by encouraging tree planting and sodding. Window gardening should be encouraged, especially on those streets where the houses are close to the sidewalk. Legislation is already provided for keeping houses back of the street line.

The municipality can very much improve the city in its attractiveness by passing and enforcing regulations for smoke prevention and for removing noise nuisances—such as train whistling, etcetera—and by prohibiting sign boards on private property.

Reference has already been made to the selfish methods of many landowners in opening up their new sub-divisions. They should be prevented, if possible, from dividing residential property into individual lots too small or of unsuitable form for gardening and planting, and they should be encouraged to place restrictions upon the locations of houses on their lots. It would not be amiss here to draw attention to the frequent misrepresentation of the location and features of subdivisions placed before the public which has become so common of late, not so much in Ontario as in the West. While everyone admits that the speculative holding of land within a city is a detriment to its growth, no effective or equitable legislative measure to prevent it is yet apparent, unless it be by an entire reconstruction of our taxation system.

## FOURTH DIVISION

### Land Outside the City

Under modern conditions of transportation and the inevitable expansion of suburban areas outside cities, we at once become interested in the development of the country surrounding the city.

Two vital points arise. The city authorities, under the terms of the "Cities and Suburbs Plans Act," have control over the layout of sub-divisions immediately adjoining the city limits; that they should co-ordinate street planning or street widths with those inside the city, is an absolute necessity. The city, however, does not exercise any control over such questions as park and open space allowances in such sub-divisions. Legislation permitting this should be secured.

The arrangement and improvement of township and county roads to make them easy and convenient for transportation and attractive as interurban drives and parkways, is of special interest to a city or group of cities, providing, as it would, a ready means of bringing farm products into market as well as convenient interconnection between towns. This would have a direct bearing on the cost of living and the attractiveness of a group of towns, and of the intervening country as a place for residence and business. A noteworthy example of this development on a large scale is the Essex County park system in New Jersey.

## Conclusions and Recommendations

The cities and towns of Ontario, and especially those in the area between the Great Lakes, stand unique in Canada as being so grouped and favored by location as to benefit from hydro-electric power for industrial purposes. They become, in addition to their former activities, each a special industrial centre and their future depends much on this ability to expand while retaining attractive homes for their workers.

In this review of the subject of civic improvement many of the illustrations and the motives have been drawn from the experience and activity of the larger cities, but, as has been pointed out, there are very many openings for the adoption of similar improvements and projects in the smaller towns and cities of Ontario. These cities can still be unique by leading in town planning and improvement as well as by leading in industrial activity.

Each city has its own specific outstanding feature. It may be its geographic situation or its transportation facilities, or its contiguous country. It may be some physical feature of landscape. Whatever these features may be they can all lend themselves to practical utilization, combined with attractive treatment.

Those who live in these towns and cities can suggest lines along which the particular improvement might follow. Your civic officials, energetic and able though they may be in their proposals for improvements, probably have their hands tied by lack of public support and certainly they are powerless through inadequate laws. The civic authorities require more power and the citizens more understanding and information as to the benefits to be derived.

Much of the momentum for a movement of this character must come from the citizens themselves and from a sympathetic press which fully grasps the significance and advantages of the movement.

In order to inform our citizens it would appear that in each city a small committee or commission should be formed for the purpose of making a study of the possibilities which present themselves. They might be empowered to secure an expert to advise either on a general scheme or upon some particular detail. Any schemes arising from this preliminary study might then be discussed by the civic authorities and the citizens, and some comprehensive programme adopted. Much can be accomplished by the adoption of such a method, for in a matter of this kind it is advisable to thoroughly mature a proposed scheme.

## A Commission and the Method of Financing

It will, of course, be asked how such projects could be financed. The municipality may devote a definite portion of its tax rate each year for the upkeep and improvement of existing works, for the purchase of new lands and for the construction of new works. Toronto has adopted this principle for its parks. If it was possible to capitalize a yearly sum or a portion of it, and suitable legislation could be obtained, a capital sum might be raised by debentures and the proceeds devoted to new work and purchases of lands, the whole managed and controlled by a special commission apart from the City Council. One of the advantages of a commission would be that it could enter into real estate transactions without publicity, and thus save money which could be put into actual improvements. Such a commission would require to be invested with special powers by the Legislature to enable it to carry on the financing of such projects; the relations of such a commission to the Ontario Railway and Municipal Board would require to be clearly defined.

To give effect to any proposals which might be made as a result of this and other conferences of representatives of various Ontario municipalities, it would seem advantageous to appoint a general committee to consider the various problems which arise.

## Special Legislation Required

In view of the experience acquired in the study of these questions in Toronto, and in view of the situation existing throughout Ontario, it would appear opportune for the municipalities to seek, through their committee, such legislation as would facilitate those civic improvements which may be desirable. This legislation might include, amongst other enactments:

Provision for civic improvement commissions in the smaller cities.

Provision, applicable to cities smaller than already provided for in the Ontario Act, for the purchase by municipalities of lands required for opening streets with an adequate margin on each side which, after the opening has been completed, can be resold as lots, thus producing a revenue to help meet the cost.

Provision for municipalities of less than 50,000 to secure streets wider than 66 feet on new subdivisions when necessary to conform to a town planning scheme.

A practical method for any necessary widening of business streets.

An adequate control over new subdivisions so that the layout will conform to modern requirements and so that misrepresentation cannot be practised. The embodiment of information such as contours and elevations is to be recommended.

## A SCHOOL DINNER IN OTTAWA

Some time ago a committee was formed in Ottawa to go into the matter of a proposed School Dinner. Early in February a meeting was held at which it was decided to make definite arrangements for such a gathering of School men in Ottawa during the winter. A solicitation of opinions from the graduates resident in the city resulted in a great deal of encouragement to the committee in this respect, and a date was definitely decided upon, Saturday, March 28th.

Dean Galbraith was the honored guest at the function. Major C. H. Mitchell, '92, a member of the Board of Governors of the University of Toronto, was also in attendance. Professors C. H. C. Wright, '88, and T. R. Louden, '05, represented the School. Mr. F. C. Mechin, '14, attended as representative of the undergraduate body of the School rather than in his official capacity as president of the Engineering Society.

From Montreal came Messrs. Walter J. Francis, '93; D. C. Tennant, '99; L. R. Wilson, '09, and several other prominent graduates and members of the Toike-Oike Club of that city. Mr J. L. Morris, '81, the earliest graduate of the institution, was in attendance from Pembroke. In all, over eighty School men were in attendance at the dinner, which was held at the Chateau Laurier.

The meeting was spectacular in that among its members were many of the most prominent of the engineering profession in Canada.

Mr. Thos. Shanks, '99, a past president of the Engineering Society, executed his duties as toatsmaster in a highly entertaining and delightful manner. The speeches throughout were typical of those of School men in their brevity and concentration upon the general theme of the meeting. No speaker overlooked the opportunity of adding his little quota of respect and gratitude to the distinguished guest of the evening, and many were the reminiscences which were allowed the freedom of spoken word from those whose good fortune it has been during the past thirty-five years to have been associated at one time or other with Dr. Galbraith. No better expression of graduates appreciation could have been summed up and presented in fewer words than those that were spoken by Mr. Shanks in his remarks, which opened an evening of genuine School loyalty to the head of the Faculty.

Beginning then with the class of 1881, which was 100 per cent. in attendance in the person of Mr. Morris, representatives of each and every class were called to their feet, and it is remarkable how few links were lacking from the complete fraternal chain to which succeeding years have added with increasing numbers since the beginning of technical engineering education in Canada. There is little doubt but that every centre of population of any extent in the Dominion has a good representation of graduates of the School, which is but another argument that might be added to the voluminous store in vindication of the universality of the broad lines upon which Dr. Galbraith had moulded their training.

To Messrs. Shanks, Challies and Stacey and their associates in the organization of the affair, is due a great deal of credit for the absolute success of the dinner. The fact that over eighty School men were in attendance speaks for itself, and the proceedings were of such a calibre that the pioneer work has already been accomplished with respect to many repetitions of the eventful occasion.

It has since been announced that School men in Ottawa have established a permanent organization and that a virtual Ottawa Branch of the Engineering Alumni Association has thus been formed. This has a significance of its own. It means that there are now branches of the Alumni Association spread over the country in such

A REPRODUCTION OF THE AUTOGRAPH PAGE OF THE ARTISTIC FOLDING MENU WHICH WAS HANDSOMELY BOUND IN MOROCCO AND PRESENTED TO DEAN GALBRAITH a way that over half the graduate body of the School may count themselves as active members thereof. It is to be expected that Winnipeg will shortly fall in line as there is a quite sufficient portion of the graduate body resident in that city to establish a healthy, progressive branch. The benefits which will accrue to themselves, to the graduates in general, and to the School, are obvious to all those who have enjoyed a participation in the activities of other branches.

It is good to know that the enthusiasm of the School men of Ottawa, as exhibited on the occasion of this very successful banquet to Dean Galbraith in the Chateau Laurier a few weeks ago, has taken permanent form by the organization of an Ottawa branch of the Engineering Alumni Association of Toronto University. There are very nearly one hundred School men in Ottawa, and many of them occupy prominent and important positions in the service of Canada. Each year a considerable number of recent graduates of the School are taken into the various branches of the departments and it has been felt for some years,—especially by those who are occupying responsible administrative positions in the service, whose work requires them to be continuously on the lookout for desirable assistance to be added to their staffs,—that some closer means should be provided for the School men of Ottawa to get acquainted with each other for their mutual benefit and for the advancement of the interests of the old School. The desirability of such a move was urged by Dean Galbraith during his recent visit to Ottawa, and the unanimous opinion of the School men at the banquet was that the committee that had made it possible, and such a unique success, should be instructed to make the necessary arrangements for some sort of permanent organization. This committee has recently met and decided to continue its present organization as the first executive of a permanent Ottawa Branch of the Engineering Alumni Association of Toronto University. Mr. Thomas Shanks, class '99, assistant surveyor-general, is president, Mr. J. B. Challies,, class '03, superintendent of the Dominion Water Power Branch, Department of the Interior, secretary, and Mr. W. F. M. Bryce, class '08, assistant to the city engineer, Ottawa, treasurer. The rest of the executive consists of Messrs. R. S. Smart, G. E. Stacey, F. Withrow, H. Barber, G. H. Ferguson, R. W. Morley and A. C. T. Sheppard.

The above officers and the executive of the Ottawa Branch will be very glad indeed to afford all School men every possible assistance in getting acquainted with other School men in Ottawa, or in connection with any matter pertaining to the best interest of the old School or of School men.

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A number of "School" men are engaged with the Hollinger Mine, Timmins, Ont. H. M. Steven, B.A.Sc., '10, is chief engineer, V. H. Emery, '10, is underground superintendent, and Chas. B. Williams, is engaged on mill building design.

M. B. Heebner, B.A.Sc., '11, is engineer in charge of construction work for the Foundation Cement Co. at Pitt River, B.C.

## THESES FOR THE DEGREE OF B.A.Sc.

The following is a complete list of the Theses presented by men of the IV year, 1913-14 for the degree of Bachelor of Applied Science. The bracketted figure following each name designates the course the candidate is following, thus: (1) Civil Engineering; (2) Mining Engineering; (3) Mechanical Engineering; (4) Architecture; (5) Analytical and Applied Chemistry; (5) Chemical Engineering; (7) Electrical Engineering; (8) Metallurgical Engineering.

| CANDIDATE | | TITLE OF THESIS |
|---|---|---|
| E. M. Abendana | (1) | The Principles of Scientific Management. |
| F. C. Adsett | (1) | Steel Rail Failures. |
| J. L. Alton | (1) | Flat Slab Floor Systems. |
| C. E. Armer | (7) | The Use of Live and Exhaust Steam at Low Pressures for Heating Public and Commercial Buildings. |
| F. C. Andrews | (2) | The Nature of the Break in Blasting. |
| H. R. Banks | (2) | The Clay Industry. |
| E. L. Bedard | (1) | Water Works. |
| H. J. Bedard | (1) | Infiltration of Ground Waters. |
| J. T. Belcher | (1) | Difficult Foundations. |
| S. G. Bennett | (1) | Roadways. |
| P. V. Binns | (1) | Water Supply—Irrigation Reservoirs. |
| J. M. Blyth | (1) | Reinforced Concrete Girder Bridges for Highway Traffic. |
| A. R. Bonham | (5) | The Oxygen Dissolved in Water—Its Sanitary Significance and Methods of Determination. |
| J. H. W. Bower | (1) | Masonry Structures as Used on Railroads. |
| H. H. Brown | (3) | Ingot Moulds—Their Manufacture, Inspection and Defects. |
| W. D. Brown | (7) | Application of Electricity to Modern Saw-Milling. |
| D. H. Campbell | (1) | Water Purification. |
| H. A. Campbell | (7) | A Comparison of the Suitabilities of D.C. and A.C. for Heavy Trunk Line Electrification. |
| H. M. Campbell | (3) | Mechanical Refrigeration. |
| J. J. Campbell | (1) | Bitumen in Modern Highways. |
| C. N. Candee | (6) | The Manufacture of Gasoline. |
| R. T. Carlyle | (2) | An Investigation of the Use of Various Inert Materials in the Making of Sand Cement. |
| J. M. Carter | (2) | Cyanide Treatment of Gold Ore by Percolation. |
| E. V. Chambers | (2) | Investigation of Clays and Shales in Canada. |
| R. M. Christie | (1) | The Reinforcing of Concrete for Wall and Column Footings for Buildings. |
| K. M. Clipsham | (3) | Report of Some Experiments made with a view to Determining the Effect in Small Gasoline Engines of Variations in Clearance and Valve Area. |
| C. E. B. Corbould | (7) | Investigation as to Water Power Development. |
| E. D. W. Courtice | (3) | A Water Works Pumping Station. |
| J. W. Crashley | (1) | Floor Slabs. |
| A. W. Crawford | (7) | A Description of the Methods of Generating, of Transmitting and Utilizing Power in the Single Phase System on Heavy Track Systems; Also a Brief Comparison with other Systems, and the Method of Choosing the System. |
| W. Cuthbertson | (1) | The Railway Timber Trestle. |
| G. F. Dalton | (1) | Concrete Trestles and Viaducts. |
| R. Dashwood | (1) | Retaining Walls for Earth. |

| CANDIDATE | | TITLE OF THESIS |
|---|---|---|
| R. D. Davidson | (1) | Base Lines. |
| R. D. Delamere | (3) | Experiments on Valve Area in Small Gasoline Engines. |
| F. W. Douglas | (1) | Steam Towers for High Tension Transmission Lines. |
| H. C. Edwards | (7) | Single Phase Series Motors. |
| H. F. Elliott | (3) | Design of Central Plants for Power, Heat and Light. |
| J. A. Elliott | (1) | Stream Measurement with Current Meter. |
| S. D. Ellis | (2) | An Investigation into the Mond Process. |
| H. E. Eyres | (1) | The Transition Curve. |
| O. M. Falls | (1) | Piling. |
| D. G. Ferguson | (7) | Voltage Regulation in an Alternating Current Generating Station. |
| G. O. Fleming | (1) | Sub Aqueous Foundations. |
| J. S. Fleming | (2) | The Concentration of Sudbury Pyrrhotite Ores by use of Magnetic Separators. |
| J. L. Foreman | (1) | Harbor Improvements. |
| H. J. Franklin | (7) | High Tension Protective Equipment. |
| J. G. G. Frost | (5) | The Composition of some Unknown Products of the Destructive Distillation of Wood. |
| C. H. R. Fuller | (1) | The Domestic Purification of Public Water Supplies. |
| E. I. Gill | (7) | The Automatic Speed Regulation of Water Power Turbines. |
| J. R. Gill | (2) | The Magnetic Concentration of Sudbury Pyrrhotite Ores. |
| R. W. Gouinlock | (1) | Reinforced Concrete—Column and Wall Footings. |
| C. I. Grierson | (7) | Fifty Mile 66,000 volts, 10,000 k.w. Transmission Line. |
| D. S. Halford | (2) | An Investigation of the Effects and Functions of Acids in Flotation Processes of Ore Dressing. |
| W. H. Hall | (3) | Diesel Engines. |
| G. H. Hally | (3) | Hydraulic Light and Power Plants. |
| J. J. Hanna | (1) | The Imhoff Tank System of Sewage Disposal. |
| J. H. Hawes | (1) | Rural Highways. |
| L. T. Hayman | (1) | Waterproofing Concrete in General Construction. |
| B. B. Hogarth | (1) | Measurement and Computation of Stream Flow. |
| E. E. H. Hugli | (4) | Estimating on Buildings. |
| S. A. Hustwitt | (1) | Types of City Road Pavements and their Selection. |
| W. Hutchings | (2) | Cyanide Leaching of Gold Ore. |
| A. S. Jannati | (7) | Mechanical and Electrostatic Stresses in Transformers. |
| R. P. Johnson | (1) | The Proposed Welland Ship Canal. |
| J. I. Kamman | (7) | Water and Fire Tube Boilers and their Working. |
| J. Kay | (1) | Concrete Dams. |
| N. G. Keefer | (4) | Collegiate Institute Design. |
| H. S. Kerby | (3) | Turbine Pumps. |
| J. A. Kerr | (3) | The Gas Engine. |
| G. E. Kewin | (7) | Safety Interrupting Devices for Power Circuits. |
| J. A. Knight | (1) | The Structural Value of Timber. |
| S. A. Lang | (2) | The Roasting and Leaching of Low Grade Copper Ores. |
| C. W. Latimer | (7) | High Tension Insulators. |
| R. E. Lindsay | (1) | Roof Coverings. |
| N. H. Lorimer | (7) | Transformer Oils. |
| O. G. Lye | (5) | The Recovery of Sulphur from Sulphur Dioxide in Smelter Fumes. |
| W. A. Macdonald | (2) | Flotation Concentration of Ores. |
| H. J. MacKenzie | (2) | The Roasting and Leaching of Low Grade Copper Ores. |
| A. M. Mackenzie | (7) | Design of an Electric Furnace for the Refining of Steel. |

| CANDIDATE | | TITLE OF THESIS |
|---|---|---|
| B. MacKendrick | (3) | Heating Systems. |
| W. A. MacLachlan | (1) | Concrete Dams. |
| H. N. Macpherson | (1) | Waterproofing Concrete. |
| A. H. MacQuarrie | (3) | Centrifugal Pumps. |
| J. A. Marshall | (7) | Single Phase Railway Motors. |
| J. A. P. Marshall | (1) | Concrete Highways. |
| R. G. Matthews | (7) | High Tension Insulators. |
| H. W. Maxwell | (3) | Factory Organization and Management. |
| R. C. McDonald | (1) | Field Work of Primary Triangulation as Carried on by the Canadian Geological Survey. |
| S. B. McGill | (1) | The Theory and Design of Compression Members. |
| D. L. McLaren | (7) | Distributing Transformers. |
| P. H. McQueen | (3) | Governors for Steam and Gas Engines. |
| C. A. Meadows | (1) | The Inspection of Structural Iron and Steel. |
| P. W. Meahan | (2) | Flotation Concentration of Ores. |
| F. C. Mechin | (1) | Concrete Highways. |
| W. G. Millar | (1) | Contractors' Plants for Handling Concrete. |
| A. S. Miller | (1) | Bridge Foundations. |
| W. E. Milligan | (6) | An Investigation into the Mond Process. |
| P. H. Mills | (7) | Self Propelled Railway Cars. |
| J. S. Mitchell | (1) | Brakewater Construction. |
| J. R. Montague | (1) | The Investigation of Storage Required for Maximum Continuous Output at a Power Plant. |
| D. Morrison | (6) | The Reclaiming of Waste Vulcanized Rubber. |
| G. J. Mullins | (1) | Concrete Abutments. |
| E. P. Muntz | (1) | Reinforced Concrete Slabs. |
| C. L. Nicholson | (7) | Some High Tension Transmission Line Difficulties and Methods for their Remedy. |
| J. B. Nicholson | (1) | Concrete the Modern Road Material. |
| C. Noecker | (1) | Tunnel Construction. |
| J. A. Owens | (1) | Clays and Clay Working. |
| A. H. Parker | (1) | Purification of Public Water Supplies. |
| R. G. Patterson | (1) | Wind Bracing in Tall Steel Buildings. |
| J. D. Peart | (7) | The Electric Furnace in the Iron and Steel Industry. |
| C. W. Pennington | (1) | The Construction and Maintenance of Macadam Roads. |
| C. V. Perry | (1) | Concrete Abutments—Their Design and Construction. |
| W. E. Phillips | (5) | Oxidation of Ammonium Sulphite. |
| G. O. Philp | (7) | Transformer Sub-Stations. |
| W. M. Philp | (7) | Gas-electric Motor Cars. |
| P. H. Raney | (1) | Fireproof Steel Construction. |
| R. H. Rice | (1) | Slow Sand Filtration of Water. |
| A. S. Robertson | (7) | Application of A.C. and D.C. Motors for Factories. |
| J. M. Robertson | (4) | Building Foundations. |
| H. D. Rothwell | (7) | Electrification of Steam Railways. |
| F. S. Rutherford | (1) | The Contractors' Concrete Mixing Plant. |
| J. G. Scott | (3) | Boilers. |
| F. M. Servos | (7) | High Tension Insulators. |
| J. G. Shepley | (2) | Conditions for Cyanide Leaching. |
| H. L. Sheppard | (1) | Stream Flow and Its Effect on Hydro-electric Power Plant Design. |
| N. E. D. Sheppard | (1) | Flow of Water over Dams. |
| S. Shupe | (1) | Concrete in Sewer Construction. |
| A. W. Sime | (6) | The Distillation of Wood. |
| B. N. Simpson | (1) | Reinforced Concrete Dams. |
| C. E. Sinclair | (1) | Retaining Walls. |
| J. B. Skaith | (1) | Concrete Piling. |
| W. C. Skinner | (4) | A Masonic Temple Design. |
| G. E. Smith | (5) | Halogen Derivatives of the Fatty Acids in Natural Fats. |

| CANDIDATE | | TITLE OF THESIS |
|---|---|---|
| H. M. Smith | (1) | Foundation Substructures. |
| G. M. Smyth | (2) | Investigation of Canadian Clays and Shales. |
| N. L. Somers | (1) | Plain and Reinforced Concrete Culverts. |
| R. O. Standing | (7) | Waterwheel Governors. |
| E. C. R. Stoneman | (7) | Storage Batteries. |
| I. R. Strome | (1) | Soft Ground Tunnelling. |
| S. G. Tackaberry | (3) | Internal Combustion Engines. |
| J. S. Taylor | (2) | The Breaking of Rock with Explosives. |
| C. N. Temes | (1) | Tunnels and Tunnelling. |
| E. H. Tennent | (3) | Automobile Gasoline Engine Design. |
| J. A. Tilston | (1) | Irrigation—Applying to Western Canada. |
| G. E. Treloar | (1) | Piles and Pile Driving. |
| W. S. Tull | (7) | Adaptation of the Synchronous Motor to Power Factor Correction. |
| E. A. Twidale | (6) | Manufacture of Alkali Bichromates. |
| F. T. VanDyke | (1) | Pneumatic Caissons for Buildings. |
| M. F. Verity | (3) | Mechanical Stokers. |
| H. O. Waddell | (1) | Foundations for Tall Buildings. |
| H. W. Wagner | (1) | Forms for Concrete Building Construction. |
| H. D. M. Wallace | (1) | Movable and Bridge Dams. |
| P. L. Whitley | (1) | Highway Construction. |
| A. E. Wigle | (6) | Separation of Solids from Liquids. |
| J. A. H. Wigle | (7) | Lightning Protectors and Arresters. |
| A. C. Wilson | (4) | Gothic Church Design. |
| H. P. Wilson | (1) | Rivetting and Rivetting Appliances. |
| R. W. Young | (2) | Conditions for Cyanide Leaching. |

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T. H. Bartley, '11, is at Sudbury, Ont., employed on location work for power transmission lines.

R. G. Sneath, B.A.Sc., '11, is on the engineering staff of the New Welland Ship Canal at St. Catharines, Ont.

G. M. Hamilton, B.A.Sc., '11, is on the engineering staff of the Welland Canal at Humberston, Ont.

W. J. Moore, '06, has been appointed Town Engineer of Pembroke, Ont.

T. H. Kettle, '09, is assistant sales manager for the Milwaukee Light and Power Co., Milwaukee, Wis.

A. J. McPherson, B.A.Sc., '93, formerly chairman of the Highway Commission of Saskatchewan, has been appointed to the chairmanship of the Government Finance Committee of that province.

R. P. Weir, '08, has been appointed district representative for the Cutter Company of Philadelphia, with offices in the Traders Bank Building, Toronto.

At the final examinations held in February for Ontario Land Surveyor, the following "School" graduates were successful: S. G. MacDougall, B.A.Sc., '10, Ottawa; G. L. Berkeley, '11, Toronto; M. E. Crouch, '11, Pembroke; K. Huffman, '11, Toronto. With supplemental: J. M. Riddell, B.A.Sc., '13, Thessalon, Ont; S. J. Pepler, '11, Toronto.

J. H. Shaw, '98, has been elected a member of the council of management, Ontario Land Surveyors' Association.

J. Van Nostrand, '09, and A. E. Jupp, B.A.Sc., '06, have been appointed auditors for the Association for 1914.

# APPLIED SCIENCE

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DEVOTED TO THE INTERESTS OF ENGINEERING, ARCHITECTURE
AND APPLIED CHEMISTRY AT THE UNIVERSITY OF TORONTO

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# EDITORIAL

**THE ALUMNI DIRECTORY**

We have the names of several graduates on our fyle whose addresses we do not know. It is a difficult task to keep in touch with over two thousand men, especially when they are engaged in work which necessitates frequent changes of location. Our readers can help us a great deal in this matter and any information which we receive will be appreciated by a large number of the alumni. This is one case where we can all work together for the benefit of each other. May we not count on you to do your share?

## RETIRING ADDRESS OF PRESIDENT MECHIN

Gentlemen—

As it is customary for the retiring President to review the work of the past year, with your permission, I will now make a few remarks to that purpose.

When mapping out the work of the year it has been our plan to have at least one speaker at the general meetings to represent each branch of Engineering. This has been carried out as far as possible, and we have been fortunate in having address the society men of high professional calibre and wide experience.

Mr. Walter J. Francis of Montreal, Mr. Frank B. Gilbreth, New York; Dr. McCulloch of Toronto; Mr. H. F. Ballantyne, New York; Mr. F. N. Speller, Pittsburg; Dean Orton, Ohio; Professor Angus and Professor Haultain have addressed the general meetings. The sectional meetings have also been well attended and the Vice-Presidents are to be commended for the excellent work of the same.

E. D. Gray, President 1914-15

At all possible meetings of the Society as well as at other functions of the "School," the "Toikeoikestra" has unselfishly entertained us under the able leadership of Mr. G. W. F. Johnston, who, with the members of the orchestra, I commend to you for your sincere thanks.

The year has seen some important changes in the Constitution. The raising of the fee from $1.00 to $2.00 was a necessity owing to the somewhat unsatisfactory condition of the Society finances. The Society has reached a point in its development where it must have more money to carry on the larger undertakings, or take a step backward. It is pleasing to note that you voted unanimously in favor of progress. The increased fee will not be a cure-all for the treasury trouble, and, only by strict economy by your executive, and by your loyal support to the Supply Department, will the Society be carried over the present adverse period of its existence. I refer to the decreased registration at the School and the present general financial conditions on the outside which affect our finances to no small extent.

The change of probably greatest importance is the confederation of clubs under the Engineering Society. This was undertaken to offset the obvious disintegration of School interests, to further stimulate college spirit, encourage closer social relations among our members and encourage individual literary and oratorical improvement as well as to maintain the esprit de corp which has made the School men prominent in the University.

This change will do away with the sectional meetings which will be replaced by general meetings or any other form of entertainment the committee may see fit to introduce so long as it is within the scope of the objects of our Society.

The Dinner given in honor of our Beloved Dean was a success, being attended by graduates from all parts of Canada and United States and a large number of undergraduates. The success of this Dinner was due to the universal esteem and popularity of Dean Galbraith.

The Dance was also a success, socially and financially.

The Applied Science and Supply Department under the management of Mr. Ritchie is showing steady progress.

We are greatly indebted to Mr. H. Irwin for the great assistance he gave the Society during the summer months, having edited our JOURNAL free of charge during that time.

The relation between the staff and your executive has always been most cordial and your thanks are especially due to Dean Galbraith and Professor Wright. It would be impossible to estimate the services rendered to us by these two gentlemen.

It has always been a great pleasure for me to work with the strong executive with which I have been associated. They have been untiring in their efforts and to them belongs the credit for what may have been accomplished during the year.

In conclusion, I wish to thank you sincerely for the honor you have done me and which it has been my honest endeavor to merit.

I take great pleasure in presenting to you the President-elect for 1914-15, Mr. E. D. Gray.

## MONTREAL TOIKE OIKE CLUB

At a meeting recently held the following officers were elected for 1914 by the Montreal Toike Oike Club:

Past President: Robert A. Ross, E. E., '90.

President: Walter J. Francis, C. E., '93.
Vice-President: W. D. Black, B. A.Sc., '09.
Sec'y-Treasurer: R. E. Watts, B.A.Sc., '13.
Advisory Council
J. M. R. Fairbairn, Grad. S. P. S., '93.
J. M. Robertson, Grad. S. P. S., '93.
D. C. Tennant, B.A.Sc., '99.
L. R. Wilson, B.A.Sc., '09.
C. W. B. Richardson, B.A.Sc., '07.

The "School" club in Montreal has been very active, and have always shown a great interest in the "School" and matters relating to the "School," and the Engineering Society. Many other of the larger centres might profitably follow their example. Such a club not only is conducive to a healthy "School" atmosphere, but also affords a pleasant medium for friendly social intercourse.

## THE STRUCTURAL CLUB

The Structural Club consisting of fourth year men in the Structural Engineering Option was formed early in November, 1913. The officers elected were as follows: Honorary President, Prof. C. R. Young; President, C. A. Meadows; Vice-President, H. M. Smith; Secretary-Treasurer, F. W. Douglas; Official Photographer, H. P. Wilson.

The Club had for its objective, the supplementing of the School Curriculum by holding dinner meetings addressed by experienced engineers, and by conducting trips of inspection to engineering works in the city.

Addresses were given by A. F. Wells, '04, of the firm "Wells & Gray, Contractors," on the subject "Contracting," and by Mr. C. W. Noble, on the subject "The Philosophy of getting and holding a job." These addresses were keenly appreciated and were followed by a lively discussion. Papers were read by several members of the club on subjects familiar to them and were the means of presenting to the club the practical aspect of construction.

During the Fall term trips of inspection were made to the new Dominion Bank and Royal Bank Buildings, under the direction of Mr. Oxley, of Harkness & Oxley, Structural Engineers, when the buildings were in various stages of completion, and the methods of construction of many trades were quite readily seen. The club also visited the plants of The Dominion Bridge Co., McGregor and McIntrye Co., Toronto Structural Steel Co., Roman Stone Co., and the National Cash Register Co. A visit was also made to the C. P. R. Grade Separation Work, where subway construction was seen in all stages. The arrival of winter prevented other tours of inspection.

As a final windup for the year, the club is holding a dinner and theatre party on the evening of the last examination day.

## A "LAKE OF THE WOODS" BOARD RECOMMENDED

A report of the Privy Council Committee, which was approved by the Governor-General on March 2, 1914, deals with the organization of a Board, representative of different departments of the Government, for the special consideration of various questions that are being referred from time to time to the International Joint Commission. Questions occasionally arise in which more than one Department are interested, and in regard to which several departments have special knowledge.

In order that such questions may be fully and effectively dealt with, it is desirable that there should be some method by which advantage may be taken of the information possessed by the different departments, and thus greater co-operation secured in dealing with the problems involved.

In the United States such matters are within the jurisdiction of, and dealt with by, the War Department alone.

At the present time the question which required the most urgent consideration is the one involved in the reference regarding the level of the Lake of the Woods, and it is suggested that a Board be organized for the special purpose of considering it, and outlining a policy for submission to the Government.

The report recommends that the working members of the Lake of the Woods Board should be representatives of the various departments affected. The Department of Marine and Fisheries and the Department of Public Works are responsible for the navigation of the Lakes; the Fisheries Branch of the Department of Marine and Fisheries is interested in the propagation and care of fish and, therefore, in any change of level which may affect the spawning beds; the Department of the Interior is much interested in the water powers connected with the water shed of the Lake of the Woods, particularly those in the Province of Manitoba; The Hydro-Electric Power Commission of Ontario is interested in the water powers in the Ontario section of the watershed; and the Department of the Naval Service is charged with the work of preparing charts for navigable waters.

The committee submits that in view of difficulties that may be encountered in getting representatives from these various Departments to act together, and in order to facilitate direct communication with the Government, it is suggested that a member of the Cabinet should be the Chairman of the Board.

They accordingly recommend the constitution and appointment of such a Board under the Chairmanship of the Minister of Marine and Fisheries, to consist of the following members as representing the Departments set opposite their respective names.

The Honourable
The Minister of the Interior.

| | |
|---|---|
| Department of Marine and Fisheries | Mr. B. H. Fraser |
| Department of Public Works | Mr. S. J. Chapleau |
| Department of the Interior | Mr. J. B. Challies |
| Department of the Naval Service and External Affairs | Mr. W. J. Stewart |
| Ontario Hydro-Electric Commission | Mr. H. P. Acres |

It is also recommended in the report that the Board be instructed to examine the various departmental interests involved, bring them into harmony as far as possible, and present to the International Joint Commission the views of the Government of Canada on this question.

Authority should be given to the Board to appoint the requisite number of clerks, or junior engineers to collect and tabulate such data as may be collected; and further (with the concurrence of the Prime Minister that the necessary expenses in connection with the carrying out of these proposals be defrayed from the contingencies of the Department of External Affairs.

## CLASS '09 HAD A REUNION DINNER

The members of Class '09 who are resident in Toronto gathered to a little reunion on April 7th. Twenty-six of the class were in attendance, while a number, unable to be present, notified the secretary, Mr. Workman, of their disappointment and of their hope that similar reunions would be frequently held.

Mr. John E. Burns, of Burns & Langrill, represented the president, W. D. Black, and after imparting to the assembly some impressive facts concerning the great and near-great men of the year, he took occasion to call the attention of those present to the untimely death of a member of the class in the person of Mr. C. E. Johnston, which had occurred since the previous meeting.

The speaker of the evening was F. A. Dallyn, C.E., of '09. provincial sanitary engineer of Ontario. Mr. Dallyn outlined his work, and that of the International Waterways Commission in connection with the investigation into the pollution of the boundary waters between Canada and the United States. He emphasized the great importance of legislature and restrictive regulations in the matter of promiscuous dumping of sewage into boundary waters, and of improper purification of water supply.

Mr. Dallyn's remarks were of exceeding interest and his modest recapitulation of his work during the past year or two was received with hearty applause.

After dinner the meeting adjourned and took the form of a theatre party where the men had an opportunity for quiet conversation and for acquainting themselves of each other's activities in engineering.

Following, a smoker was given by Mr. Bert Allison at his home where the musically inclined had a generous apportionment and the conversationalists gave vent to their long pent-up reminiscences.

It was decided to hold frequent social evenings of like nature in order to keep the men of the year who are situated in Toronto in close touch with each other. Arrangements were settled for another meeting to be held on May 11th, the speaker to be Mr. J. A. Mackenzie Williams.

## WHAT OUR GRADUATES ARE DOING

J. M. R. Fairbairn, '93, is Assistant Chief Engineer for the Canadian Pacific Railway. He is located at Montreal. The information in the directory last month was in error.

W. T. Curtis, B.A.Sc., '13, is with the Dominion Reduction Co. at Cobalt, Ont, not the Buffalo Mines.

Quebec Extension (Electric). An officer writes that contracts are to be let next spring to build from Washburn, Me., which is on the Aroostook Valley, west through the northern part of Maine to a point in Montgomery county, Que., 111.6 miles west of Washburn. This line is to form part of a through line to connect the Canadian transcontinental lines with the Atlantic winter ports. A. R. Gould, president of the Aroostook Valley Railroad, at Presque Isle, Maine, is president of the new company, and S. B. Wass is chief engineer, Fredericton, N. B. Mr. Wass is a graduate of 1903.

At the annual meeting of the Saskatchewan Land Surveyors' Association held in Regina a short time ago, W. A. Begg, B.A.Sc., '05, was elected vice-president, H. G. Phillips, B.A.Sc., '08, secretary-treasurer; W. M. Stewart, B.A.Sc., '06, counsellor, and O. F. Coumans, '11, auditor.

Among the successful candidates at the Dominion Land Surveyors' Association examinations held recently were the following "School" graduates: Final: F. Alport, B.A.Sc., '06, Orillia; H. C. Bingham, '10, Regina; P. J. McGarry, '10, Toronto; F. H. Wrong, '11, Windsor, Ont.

Full Preliminary: H. R. MacKenzie, B.A.Sc., '13, Regina; Mr. C. H. Eckert, B.A.Sc., '11, who has been with the Standard Chemical Co. at Longford, Ont., leaves this month for an extended tour through Europe.

H. M. Goodman, B.A. Sc., '13, is in the draughting office of the Canada Foundry Co., Toronto.

W. H. McTavish, B.A. Sc., '13, has returned to Alaska to resume his work on the International Boundary Survey, after spending the winter in Otawa with the Department of Interior.

J. A. P. Marshall, '14, is with the department of works at Medicine Hat, Alta.

C. E. Brown, '15' is employed as assistant with Frank Barker, B.A. Sc., consulting bridge engineer, Toronto.

W. G. French, '16, is assistant to the division surveyor for the Canadian Pacific Railway at North Bay, Ont.

W. D. Walcott, B.A. Sc., '11, who has until recently been with the Roadways Department at the City Hall, Toronto, has returned to his home at Savanna-la-Mar, Jamaica.

R. E. Jones, B.A. Sc., '94, is with the Street Commissioner, City Hall, Toronto.

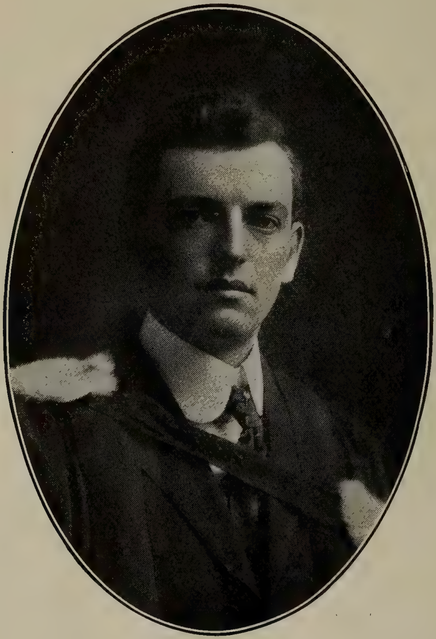
L. L. Campbell, B.A. Sc., '13, is engaged on survey work at Berkeley, California. His present address is 54 Fulton street, Berkeley, California.

# OBITUARY

## Clarence Ernest Johnston, B.A. Sc.

On December 31st, 1913, Mr. C. E. Johnston, a member of Class '09, was suddenly called away by death. He was engaged on Dominion land survey work near Elbow, Saskatchewan, when he suffered a sudden attack of appendicitis. He was immediately hurried to the hospital at Moosejaw, a distance of about one hundred miles, including a thirty mile drive and seventy miles by train, but all efforts to save his life proved futile and he succumbed on December 31st.

Mr. Johnston was born in 1882 at Mooretown, Ont. He received his collegiate education at Sarnia and registered in Arts at University College, from which he graduated in 1907 in Astronomy and Physics, receiving the degree of Bachelor of Arts. In that same year he entered the Faculty of Applied Science to take a course in Civil Engineering and upon graduation received the degree, Bachelor of Applied Science.



During his course at the University Mr. Johnston was very active in undergraduate affairs and won many true friends. He was a good athlete, being an excellent swimmer and gymnast. The high respect with which he was regarded by his fellow students is made plainly manifest by the praiseworthy remarks of his former class-mates who learned with sorrow of his demise.

To his mother and friends we extend our sincerest condolence.

# DIRECTORY OF THE ALUMNI

Fletcher, A. W., '10, is in Calgary, Alta., with the Department of Public Works.

Fletcher, F. T., '10, is also on the staff of the Department of Public Works, Calgary.

Fletcher, J. A., '10, is with E. W. Robinson, D.L.S., Fisher River, Man., as assistant.

Flint, C., '08, is in the employ of the Canadian Pacific Railway.

Flint, T. R. C., '10, is on the power engineering staff of the Toronto Hydro-Electric System, Toronto, Ont.

Flook, S. E., '11, has a private practice as Ontario Land Surveyor and Civil Engineer at 43 Cumberland St. S., Port Arthur, Ont.

Flynn, C. C., '11, is in Chicago, with the Western Electric Co., Limited.

Follett, R. C., '10, has no address upon our records except his home address, Oakville, Ont.

Foote, F. F., '13, is at Merritton, Ont.

Forbes, D. L. H., '02, is a consulting mining and metallurgical engineer with offices in Toronto. He is metallurgical engineer for the Merrill Metallurgical Co., Toronto.

Ford, A. L., '04, is government inspector and engineer, Department of Railways and Canals, at Prince Rupert, B.C.

Foreman, J. M., '10, whose home is in Lucan, Ont., has no business address with us.

Forman, W. E., '99, was in Pittsburg, with the Westinghouse Electric & Mfg. Co., construction department, when last heard from.

Forrester, C., '93. We do not know his present address.

Forward, E. A., '97, is with Haney, Quinlan & Roberston, engineers, Montreal, Que.

Forward, C. C., '06, is assistant analyst, Department of Inland Revenue laboratories, Ottawa.

Foster, A. H., '08, is manager of the Guelph Radial Railway Co. and Guelph Waterworks, Guelph, Ont.

Foster, W. J., '10. We have no address for him at present except his home address, Windsor, Ont.

Foulds, W. C., '10, is at Winnipeg in the office of the chief engineer, department of public works, of Manitoba.

Foulds, E. S., '13, is with the department of railways and canals at Campbellford, Ont., on the construction of the Trent Canal.

Francis, Walter J., '93, is the senior member of the consulting engineering firm of Walter J. Francis & Co., Montreal.

Francis, G. C., '08, whose home address is Verschoyle, Ont., has no business address with us.

Frankel, E. L., '11, is manager of Frankel Bros., dealers in metals and millstock, Toronto.

Fraser, A., '10, is in the topographical surveys branch, Department of Interior, Ottawa.

Fredin, J., '10, is with the B.C. Copper Co., at Princeton, B.C.

Freeland, E. E., '11, is with the Department of the Interior, Ottawa, in the topographical surveys branch, as assistant topographer.

Freeman, T. E., '09, is in Toronto as sales engineer for the Canadian General Electric Co.

Freeman, J. R., '11, is in the bridge department of the Intercolonial Ry. Co. at Moncton, N.B.

Frid, H. P., '11, is superintendent for the firm of Frid-Lewis Co., consulting engineers on building construction with head offices in Winnipeg.

Frost, E. R., '09, is engineer on construction work for the Foundation Co., at Pitt River, B.C.

Fuce, E. O., '03, is carrying on a consulting civil engineering practice in Calgary, Alta., in partnership with W. A. Scott, '06.

Fuller, R. J., '11, is in the city architect's department, City Hall, Toronto, as structural engineer.

Fullerton, C. H., '00, is in New Liskeard, Ont., where he has a practice as engineer and surveyor.

Fux, P. C., '07, is advertising manager for the Waterous Engine Works Co., Brantford.

## G

Gaby, F. A., '03, is chief engineer to the Hydro-Electric Power Commission, with headquarters at Toronto.

Gagne, S., '01, deceased, April 25th, 1909.

Galbraith, J. S., '13, is demonstrator in drawing, Faculty of Applied Science and Engineering, University of Toronto.

Gall, H., '10, is assistant engineer

to Frank Barber, bridge and structural engineer, Toronto.

Galletly, J. S., '07, whose home is in Brooklin, Ont., was on D. L. S. work in the west, when our last information was received.

Galt, G., '07, is superintendent of the Cobalt Comet Mine, Cobalt, Ont.

Gardner, J. C., '03, has a private engineering practice at Niagara Falls, Ont.

Garland, N. L., '90, is engaged in building and contracting in Toronto.

Garrow, A. B., '07, is assistant engineer, main drainage department, City Hall, Toronto.

Gear, S. S., '08, is city engineer of St. Catharines, Ont.

George, R. E., '03, has no address with us.

Gibbons, J., '88, was in Ottawa, department of the interior, when last heard from.

Gibson, A. E., '02, is assistant engineer with Roger Miller & Sons, engineers and contractors, Toronto.

Gibson, J. M., '10, is with the street commissioner, Toronto, preparing a report relative to proposed scheme of garbage disposal, etc.

Gibson, M. M., '10, and Gibson, W. S., '04, are members of the firm Gibson & Gibson, civil engineers and surveyors, Toronto.

Gibson, N. R., '01, is hydraulic engineer with the Ontario Power Co., Niagara Falls, Ont.

Gillespie, P., '03, is Associate Professor, Department of Applied Mechanics, University of Toronto.

Gillies, A., '07, is with the C.N.O. Ry. at Quebec, Que.

Glover, A. E., '09, is engaged in surveying in Edmonton, Alta.

Goad, V. A. E., '10, is a partner in the firm of the Chas. E. Goad Co., surveyors and civil engineers. He was in charge of their Montreal office when last heard from.

Goldie, A. R., '93, is a member of the firm of Goldie & McCulloch Co., Limited, Galt, Ont., as manager.

Goodall, J. N., '04, is engaged in civil engineering in this city.

Gooderham, A. E., '09, is chemical analyst for Gooderham & Worts, Toronto.

Gooderham, J. L., '11, is assistant chemist in the distilleries of Gooderham & Worts, Toronto.

Goodeve, V. S., '10, is at Phoenix, B.C.

Goodridge, H., '10, was in Edmonton, Alta., when last heard from.

Goodwin, A. C., '02, was with the Aluminum Co., Pittsburgh, Pa., when last heard from. We have no other address for him.

Goodwin, J. B., '92, is with the Midland Construction Co. He was at Healey Falls, Ont., a short time ago.

Gordon, J. P., '04, is assistant chief engineer, Hudson Bay Ry., Scott Block, Winnipeg.

Gordon, W. A., '10. We have not his address.

Gourlay, V. F., '10, is a member of the Canada Iron Corporation, Galt, Ont.

Graham, C. W., '06, is chief chemist, Dunlop Tire & Rubber Goods Co., Toronto.

Graham, E. B., '10, is with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Graham, G. W., '07, his home address is Eugenia, Ont. We have no record of his professional work.

Graham, D. A., '09, is resident engineer with the Canadian Northern Pacific Railway, Hope, B.C.

Grant, W. F., '98, is city engineer of Sault Ste. Marie, Ont.

Grant, R. R., '09, is engaged in surveying and contracting, with offices in Toronto.

Grasett, C. S., '07. We have not his present address.

Grassie, C. A., '08. His home address is Welland, Ont.

Gray, A., '04, is with the St. Lawrence Starch Co., Port Credit, Ont.

Gray, A. T., '97, is designing engineer on steam turbines, General Electric Co., Schenectady, N.Y.

Gray, E. R., '13, is Divisional Engineer, east of Yonge St. for the Sewers Department, City Hall, Toronto.

Gray, J. E., '09, was with the Transcontinental Ry., Edmonton, Alta., as instrument man, when last heard from.

Gray, W. W., '04, is with the Edmonton, Light & Power Co., Edmonton, Alta.

Greene, A. E., '11, has 291 Stewart St., Peterboro', for his address.

Green, R. E., '11, is manager of the Oxford Motor Sales Co., Toronto, Ont.

Greene, P. W., '06, is a member of the firm of Kortwright & Green, civil engineers, Toronto.

Greene, R. L., '10, is engineering salesman at Ottawa for the Canadian Allis-Chalmers Co. Limited, Founders and Engineers, Toronto.

Greene, W. H., '09, is assistant city engineer, Moose Jaw, Sask.